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THE recent discussions on the proposed international copyright have served to display the prejudices and animosities of those engaged in the controversy, rather than a true exposition of the actual principles involved.

It is not difficult to discover that under the plea of maintaining the rights of authors, leading publishing houses on both sides of the Atlantic are manœuvring for a "literary treaty" which shall result in their own benefit only.

How little the author has at stake as a result of all this agitation may be gathered from a statement by one who writes on the subject, perhaps not in the interest, but undoubtedly under the patronage, of one of the largest New York publishing houses.

He says: "If the author's interest in a book is represented by 10 per cent. the publisher's interest is represented by 90 per cent." It is not, therefore, surprising to find these champions of author's rights feebly contending for the protection of the works of literary men, but strongly united to secure a monopoly of the business interests involved.

The American publishers who previously were unwilling to concede to foreign authors even their "ten per cent. interest," give at length a tardy consent to a copyright treaty, provided their "90 per cent. interest" is made secure, and their possession of the monopoly rendered impregnable by law.

The New York *Herald*, on the 4th of October last, stated this case as it now stands with admirable judgment, and we are glad to find the powerful influence of this journal taking ground which is in perfect accord with the view we maintain on this important matter. The *Herald* says:

"The corner-stone of the proposed treaty is that protection in this country be given to British authors on condition that they republish here within three months after pub-

lication in Great Britain, and on the further condition that the work be issued here by an American publisher. On like terms British copyright is to be extended to American authors.

"That this scheme would work to the profit of the largest publishing houses in this country, if not of American publishers generally, there is little reason to doubt. It would be a protective measure in their interest. It would create a monopoly in their favor. It would compel foreign authors to come to them or pay the penalty of piracy. It would have no material advantages for the great reading public in either country, and so far from being favorable to either British or American authors it would work against the best interests of both. It would drive both, in order to get foreign protection, to deal with publishers three thousand miles away, and to bear the expense, loss of time, labor, and inconvenience of republication. Still more burdensome and unjust would be the condition requiring the author to republish in the foreign country within a short time after publication at home or lose all his foreign rights and claims to protection."

No impartial reader can peruse the above extract without admitting the justice of the writer's conclusions; he rips off the thin disguise which covers this ridiculous treaty, and reveals the true purpose of those engineering the movement.

The intemperate language employed by the organ of some publishing houses on this question should be noted. The Editor of *Popular Science Monthly* assails Wilkie Collins (who advocates the only right principle of international protection to literary property) with uncalled for severity; he is called "a common-place scold," and his temperate and forcible article on the subject is termed "a blast, which did not amount to much," and as "a perverse and unhelpful utterance." Was it in good taste for the same writer to tell Mathew Arnold that "he was devoid of sense?" But the conclusion of this article demands more than a passing notice, as it conveys a threat, expressed in language which is very significant considering the house from whence the publication emanates, and may be taken in the light of an ultimatum from the publishing interests to their literary patrons.

It may be remembered that Wilkie Collins simply asks that an author may possess "by law (on conditions with which it is reasonable to comply) the same right of control over his property in his book, in a foreign country, which the law gives him in his own country." This is what the New York *Herald* advocates, and we would concede to authors of all countries.

The *Popular Science Monthly* states that "if Mr. Collins [and of course all other authors] has any idea of getting it, he 'had better possess his soul in great patience,' for he will assuredly have to wait a long time before he gets what he wants."

As the writer of this threat has no authority to dictate such an order, or the power to enforce it, it may be safe to assume that it was written under the instruction of those who have the power to give it effect. To such a menace there can be but one reply; much as we desire to see justice done to authors and their rights assured by international treaty, we would, without hesitation, decline concessions thus tendered, and hampered with conditions which would destroy the essence of the gift. We would rather counsel literary men "to possess their souls in great patience," and calmly await the day when their adversaries' souls may be possessed with moderation and justice, or public opinion be sufficiently strong to secure for them their just rights.

THE reported arrival at the port of New York of two male *woolly* elephants of dwarfish dimensions, has resulted in a request from a subscriber for authentic information regarding these strange animals.

It was alleged that the elephants in question were discovered upon the Himalaya mountains, and that the hairy covering found upon their bodies, and the great diminution of the natural size, were due to the cold of that region.

The inference to be drawn from such a description was, that the present specimens were in a measure a return to the extinct *Elephas primigenius*, the remains of one of which was found at the mouth of the river Lena in Siberia, with the flesh still in a good state of preservation, showing the skin covered with hair.

We find that the new arrivals were not found on the Himalaya mountains, but were purchased at the Parah River, Malay Peninsula, after the ship had left Calcutta. Their size is normal, for their age is not four and six years; but, probably, the smaller is about twelve months old and still feeds on milk, while the larger specimen is about two years old.

All young elephants are covered with hair, which afterwards falls off as they increase in age. These animals have this infantine crop of hair somewhat abundant, but not to an extent to create any especial wonder.

As Mr. Conklin, of the Central Park Menagerie, states, our knowledge of baby elephants is very limited in this country, and perhaps after all, the apparent excess of hair on the flanks of these animals may be normal. The young elephant, born at Philadelphia about nine months since, had a similar crop of hair, but not to the same extent.

Dr. Spitzka, of New York, who has seen these young elephants, confirms the opinion we have given, and states that they are not a new species or even a

variety; and he believes that the hair will eventually disappear, and even now finds, on the larger specimens, bald spaces.

We do not desire to spoil the speculation on these animals by stating the price at which they were sold on their arrival here, but the multiplication table has not been without its use to create an artificial value.

ACCURACY IN THERMOMETERS.

By recommendation from the Winchester Observatory, a bureau has been established at Yale College with the practical view of accurate verification of these instruments. Any person may send thermometers to this institution for the purpose of having them compared with the standard thermometer, and any variation from the accurate standard will be recorded. For the purpose of defraying the expense of these comparisons, the following scale of charges has been adopted for this verification: For standard meteorological thermometers, one dollar; for ordinary meteorological thermometers, fifty cents; for ordinary maximum thermometers, seventy-five cents; for ordinary minimum thermometers, seventy-five cents; for clinical thermometers, fifty cents. In case more than eight instruments of one kind are submitted at the same time, twenty per cent. will be deducted from these charges. Clinical thermometers, in numbers of two dozen or more, will be verified for four dollars a dozen. For thermometers of exceptional pattern, the charge will vary according to the character of each instrument. Communications relative to this subject may be addressed to Leonard Waldo, New Haven, Conn.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

The accumulation of material at Washington illustrative of the several branches of Anthropology, has drawn together a large number of specialists in Comparative Anatomy, Archaeology, Ethnology, Linguistics, and Sociology. For mutual improvement a number of these gentlemen have organized the above-named society, with Major J. W. Powell as President, Dr. Elmer R. Reynolds as Secretary, and Professor Otis T. Mason as Corresponding Secretary. The facilities which the Army Medical Museum and the Smithsonian Institution, with its Bureau of Ethnology, furnish for the preservation of valuable papers obviate the necessity for a voluminous journal of the Society. We have made arrangements, however, to present abstracts of communications and discussions on the week succeeding the meetings, which take place on the first and the third Tuesday of each month. The following is a *résumé* of the proceedings of Tuesday evening, October 20th:

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Hr. Hough's paper related to the influence of the inheritance of knowledge and character as making progress in civilization possible. Each individual and each race is the outcome of all those material and psychical causes which have co-operated to bring them into existence. These facts were used by the author to show that the civilization of our race cannot be forced upon another race. By a multitude of examples Mr. Hough illustrated the methods by which the causes which give rise to races and phases of culture are brought together and co-operate to their end. The paper was discussed by Mr. Lester F. Ward, Major J. W. Powell, Professor O. T. Mason and Colonel Garrick Mallery.

THE PRIORITY OF THE LATE FRIEDRICH MOHR IN REGARD TO THE PRINCIPLE OF THE CONSERVATION OF ENERGY.

By DR. GEO. W. RACHEL.

In an interesting essay entitled, "*On the History of Forces*," published by DR. C. K. AKIN in the *Philosophical Magazine*,¹ occurs the following passage:

"There has been of late a good deal of controversy regarding the priority of invention or discovery of this last named principle [Correlation of Forces] and it may be interesting, in a historical point of view, to take cognizance of passages of much earlier date than hitherto relied upon as establishing such priority, and upon which I have in the majority of cases rather accidentally lighted."

The controversy alluded to by DR. AKIN in the passage quoted, may be said to have continually attracted the attention of scientists since the above reference was made to it sixteen years ago. It is well known that TYNDALL's authoritative statement of DR. ROBERT JULIUS MAYER's priority has been accepted almost universally since it first appeared.

And yet there always was a number of scientific men who held another opinion; but in spite of their protests, even to-day the authority of TYNDALL prevails, and the popular notion all over the civilized world is that MAYER first discovered and proclaimed the great principle in question. This view, however, is erroneous, and in this paper the writer intends to prove, by the introduction of documentary evidence, that the late PROF. FR. MOHR, of Bonn, was the first who, in clear and unmistakable language, proclaimed the principle of the "correlation of forces" and the "mechanical theory of heat" on which it is based.

The history of the essay, on which his claim of priority in this matter rests, is a peculiar one, and since the circumstances attending its loss and its re-discovery have had a direct bearing on the controversy in question, they are worth mentioning.

It is certainly a unique occurrence, that a scientist should, for a period of thirty years, have been absolutely unaware of the fact that an article which for the first time in the history of science states a principle of the utmost importance, had actually been published in one of the scientific periodicals to which he sent his MS; and this was due only to the failure, on the part of the publisher or the editor, to transmit a copy of the number containing the paper to the author. But this is what really happened in the case of PROF. MOHR's article "*On the Nature of Heat*."

¹ Phil. Mag., 4th series., vol. XXVIII., No. 191, December, 1864; pp. 470-477.

MOHR first sent it to POGGENDORFF, but the latter declined its publication for the peculiar reason that "*it did not contain any new experimental researches*."² It was therefore returned

to MOHR and by him, in turn, sent to PROF. BAUMGARTNER, at Vienna, who, at that time (1837), in conjunction with DR. VON HOLGER, published and edited his *Zeitschrift für Physik und Verwandte Wissenschaften*. Not being informed by these gentlemen what had been done with the paper, he supposed it to have been shelved by them on grounds similar to those which prompted POGGENDORFF's refusal. It was only by an accidental reference to this essay in one of his later works³ that he chanced to hear of it again.

DR. AKIN wrote to him that it had been published by BAUMGARTNER and VON HOLGER, in the fifth volume of their *Zeitschrift*, etc., p. 419, a passage of it having been quoted by him [DR. A.] in the essay referred to above.

The files of this magazine—which had a very limited circulation—having become scarce, since, shortly after its publication had ceased, the publishing firm was dissolved, it was very difficult to procure a complete set. Thus it was that MOHR had to wait many months until, in response to a request, he received a copy of the volume in question, sent for temporary use only by the librarian of the *Vienna Polytechnic School*, PROF. HLASIWETZ. A letter, accompanying it, contained the following passage:

" . . . I am happy to be able to congratulate you on this important essay, which puts your priority in regard to the question of the mechanical theory of heat beyond any doubt. I am glad furthermore that I should have been instrumental in the re-discovery of this hidden treasure⁴. . . ."

Very soon after DR. ADOLPH BARTH, of Leipzig, the present editor of *Poggendorff's Annalen*, succeeded in hunting up a full set of files of the *Zeitschrift*, etc., and presented them to PROF. MOHR.

Since then the paper in question has been twice republished in full. The first time by the author himself in one of his later works, with an explanatory statement, containing the history of its loss and re-discovery as given above,⁵ and again by DR. HERMANN KLEIN in the seventh volume of his scientific monthly, the "*Gaia*" in the year 1871.

Although MOHR has never pressed his claim to priority, it is certainly due to his memory that all the facts in connection with it should become fully known. It is always to be regretted, when personal considerations—not to say animosities—come into play in such questions; but it seems as if this very matter had been destined to be the subject of an unceasing feud which has at times even taken the shape of a personal quarrel. Only a few years ago PROF. DÜHRING was 'dismissed' from *Berlin University* by a vote of the faculty, because he had accused PROF. HELM-

² For the same reason it was that the editor of the great *Annalen* declined five years later the publication of DR. MAYER's paper on the same subject, and it therefore appeared in LIEBIG's *Annalen der Chemie* (42, 240.)

³ *Mechanische Theorie der chemischen Affinität*, Fr. Vieweg; Braunschweig, 1868.

⁴ The letter bears date of Oct. 17, 1868, so that the author received and first saw the article fully thirty-one years after its publication.

⁵ *Allgemeine Theorie der Bewegung und Kraft*, etc. Fr. Vieweg, Braunschweig, 1869, pp. 80-106.

NOTE.—It is to MOHR, and the fate of this essay, that DR. AKIN refers in a passage contained in his latest letter to PROF. STOKES, which was published in No. 15 of "SCIENCE." On page 179 of this Journal he says: "Another [MOHR] who started similar ideas about the same time, having been repulsed in one quarter (POGG. ANN.) took it for granted that the same had happened to him also in another (B. & V. H. *Ztschr. f. Phys.*, &c.) where it was not the case, so hopeless did he consider his endeavor to obtain a hearing."

It is a strange coincidence that the same humiliating experience was reserved for the last months of the great man's life. For, the last three essays which he wrote, each one of them, abounding in new and original ideas, were also declined by the editors of "*LIEBIG'S Annalen*." This unwarrantable procedure so disgusted the family of the venerable philosopher that they decided after his demise not to publish them in Germany at all. They have honored the writer by intrusting to him the publication of these valuable essays, and the readers of "SCIENCE" will soon have opportunity to judge, for themselves, of the new and striking views advanced by this great thinker.

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Although MOHR has never pressed his claim to priority, it is certainly due to his memory that all the facts in connection with it should become fully known. It is always to be regretted, when personal considerations—not to say animosities—come into play in such questions; but it seems as if this very matter had been destined to be the subject of an unceasing feud which has at times even taken the shape of a personal quarrel. Only a few years ago PROF. DÜHRING was 'dismissed' from *Berlin University* by a vote of the faculty, because he had accused PROF. HELM-

² For the same reason it was that the editor of the great *Annalen* declined five years later the publication of DR. MAYER's paper on the same subject, and it therefore appeared in LIEBIG's *Annalen der Chemie* (42, 240.)

³ *Mechanische Theorie der chemischen Affinität*, Fr. Vieweg; Braunschweig, 1868.

⁴ The letter bears date of Oct. 17, 1868, so that the author received and first saw the article fully thirty-one years after its publication.

⁵ *Allgemeine Theorie der Bewegung und Kraft*, etc. Fr. Vieweg, Braunschweig, 1869, pp. 80-106.

NOTE.—It is to MOHR, and the fate of this essay, that DR. AKIN refers in a passage contained in his latest letter to PROF. STOKES, which was published in No. 15 of "SCIENCE." On page 179 of this Journal he says: "Another [MOHR] who started similar ideas about the same time, having been repulsed in one quarter (POGG. ANN.) took it for granted that the same had happened to him also in another (B. & V. H. *Ztschr. f. Phys.*, &c.) where it was not the case, so hopeless did he consider his endeavor to obtain a hearing."

It is a strange coincidence that the same humiliating experience was reserved for the last months of the great man's life. For, the last three essays which he wrote, each one of them, abounding in new and original ideas, were also declined by the editors of "*LIEBIG'S Annalen*." This unwarrantable procedure so disgusted the family of the venerable philosopher that they decided after his demise not to publish them in Germany at all. They have honored the writer by intrusting to him the publication of these valuable essays, and the readers of "SCIENCE" will soon have opportunity to judge, for themselves, of the new and striking views advanced by this great thinker.

HOLTZ of plagiarism (from DR. MAYER), in the very same matter, and used unbecoming and disrespectful language towards his colleague.

Prof. TAIT also, as our readers are well aware, has reopened the controversy and has attacked DR. MAYER and his champion, PROF. TYNDALL, in an unnecessarily virulent and aggressive manner.

It is very likely that both these gentlemen would have acted quite differently in this matter had they been informed of the fact that MOHR's priority dates back to 1837. PROF. TAIT only refers to it in the preface to the second edition of his "*Lectures on some recent advances*" &c.,* stating that he had, until very shortly before its publication, not seen or heard of MOHR's writings on the subject, whose indisputable claim to priority he at the same time admits.

In the beginning of this paper we have given the introduction to DR. AKIN's interesting, though as it seems, not very widely known essay, and we shall now proceed to give, in the same order as that adopted by him, the various passages—almost exclusively from MOHR's paper—which DR. AKIN cites in support of his view "that they must invalidate all claims to priority of an earlier date."

DR. AKIN continues (l. c. p. 473):

"The following is an extract from PLACIDUS HEINRICH's: *Die Phosphorescenz* &c., published in 1872: 'Meanwhile we know, at least with a certain degree of reliability, that nothing is lost in Nature . . . everything may be explained by constant interchange; the one gains by the loss of the other; the one takes its origin from the disappearance of the other. Therefore there is no such thing as loss in the Universe, only change and interchange.'

The next quotation is from a paper by DR. MOHR, of Koblenz, "*On Heat*," published in 1837:

'Aside from the 54 chemical elements at present [1837] known, there is but one agency in Nature and this we call *Force*; it may under suitable circumstances appear as motion, chemical affinity, cohesion, electricity, light, heat and magnetism, and by means of each of these different forms all the others may be produced. . . . If, by the force of your arm you remove an induction-coil from a magnet, an electric current will originate in the surrounding spiral wire (helix), which, on being interrupted, appears as a spark, or if the conducting wire is reduced in size, as a glowing wire (*heat and light*); it will also magnetize a steel needle if it is conducted through a helix surrounding it; it will decompose the water it passes through, annihilating its chemical affinity and its cohesion at the same time, and since the thin Platinum-wire, Ampère's helix and the apparatus for the decomposition of water, may be interpolated at the same time in one and the same chain, it is evident that the force of the human arm may appear under different conditions as heat, light, chemical affinity, magnetism and cohesion.'

"The passage is followed by two more pages, showing in greater detail the connexion and transmutability of the several known forces and a transcript or translation of which I [Dr. Akin] hope to give at some future occasion. The

author concludes his observations with the following judicious remarks:

'Without any doubt all physical phenomena produced by the so-called Imponderabilia may be classified under' one of these heads . . . But there remains an immense amount of labor to be done, before, starting from this passing suggestion, we shall arrive at a complete insight into the nature of these things.³

"With regard to heat, besides showing that its nature or form is *motion*, which is the principal object of the paper, the writer states (p. 422):

'What . . . annuls (destroys) a force, must itself be a force.'⁴

'And again (p. 422):

'What . . . produces (causes) a force must itself be a force.'⁵

Whence he concludes, considering the effects of heat (p. 421):

'Heat appears as a force in innumerable cases.'⁶

"Considering the remarks of Placidus Heinrich as a casual generalization which is found in the writings of other authors of the last century and the beginning of the present (RUMFORD, DAVY, FARADAY and others), and considering furthermore the fact that Mohr's object was to show that heat is not imponderable matter, but consists of the oscillatory motion of ponderable matter, and to prove that this is the case with all the other Imponderabilia so-called, and that because all of the latter, are interchangeable and convertible into forces, we are justified, may even forced by irresistible logic to declare all these agencies—forces as well as motions—to be different manifestations of one and the same thing, it is established beyond any doubt that FRIEDRICH MOHR was the first who in clear and convincing language stated the great principles in question.

"This does, of course, not detract from the merit of MAYER or HELMHOLTZ, or any other author who has arrived independently at similar conclusions, and no one is more ready than MOHR himself to give credit to whom it is due. In the explanatory statement given with the reprint of the essay, he quotes TYNDALL's reference to DR. MAYER's paper mentioned above and indorses the praise contained in it with all his heart. He says:

"I fully accept this statement by TYNDALL. The laying down of the mechanical equivalent of heat is one of the principal points in this matter, but it does not exhaust it. MAYER had stated it and calculated it from known facts to be 365 Kilogrammometers. That this figure is not the same we now adopt (424 K.M.), does not detract from MAYER's merits in the least; the foremost thing was to lay down the principle that mechanical motion has its equivalent in heat, that one originates from the other, that both are therefore equivalent to wit: motions.'⁷

"But he continues:

'While thus with all my heart recognizing the great merits of MAYER (and JOULE), I would be unjust towards myself if I should pass in silence over my former writings, which by peculiar circumstances have not become generally known.'⁸

* In his reprint, Mohr remarks that at most places where the word "*Kraft*" was used in this first essay, he would now have "*Bewegung*."—R.

³. Ohne Zweifel lassen sich alle physikalischen Erscheinungen der sogenannten Imponderabilien unter einer dieser Rubriken bringen. . . . Es bleibt aber von dieser flüchtigen Andeutung bis zur vollkommenen Einsicht in die Natur der Sache noch unendlich viel zu thun übrig. (s. 445.)

⁴. Was . . . eine Kraft aufhebt, muss selbst eine Kraft* sein.

⁵. Was . . . eine Kraft hervorbringt, muss selbst eine Kraft sein.

⁶. Die Wärme erscheint in unzähligen Fällen als eine Kraft.

⁷. Ich acceptire diese Aeusserung von TYNDALL vollständig. Die Aufstellung des mechanischen Aequivalentes der Wärme ist ein Haupttheil der ganzen Lehre, aber es erschöpft sie nicht. MAYER hatte (LIEBIG'S *Annalen*, 42, 240) das Aequivalent ausgesprochen und aus bekannten Thatsachen zu Kilogrammometern berechnet. Dass diese Zahl nicht dieselbe ist die wir jetzt annehmen (424 K.M.) benimmt dem Verdienste MAYER's nicht das Geringste; die Hauptsache war die Aufstellung des Satzes dass die mechanische Bewegung ein Aequivalent in der Wärme habe, dass eines aus dem andern entstehe dass beide also gleichartig sind nämlich Bewegung. (s. 80.)

⁸. Indem ich die grossen Verdienste MAYER's (und JOULE's) in diesem Zweige der Wissenschaft mit vollem Herzen anerkenne, würde ich gegen, mich selbst eine Ungerechtigkeit begehen, wenn ich nicht meine früheren Arbeiten, die durch einen, besonders Umstand nicht zur allgemeinen Kenntniss gekommen sind, stillschweigend übergehen wollte. (s. 82.)

*McMillan & Co., London, 1877.

¹. . . . Unterdeßen wissen wir wenigstens soviel mit Zuverlässigkeit, dass in der Natur nichts verloren geht . . . alles erklärt sich durch einen steten Umtausch; das eine gewinnt durch Verlust des Andern; das Eine entsteht durch das Verschwinden des Andern. . . . Also im Universum nie Verlust, nur Wechsel und Umtausch. . . . (Vol. II., s. 283.)

². Ausser den bekannten 54 chemischen Elementen gibt es in der Natur der Dinge nur noch ein Agens und dieses heisst *Kraft*; es kann unter passenden Verhältnissen als Bewegung, chemische Affinität, Cohäsion, Electricität, Licht, Wärme und Magnetismus hervortreten, und aus jeder dieser Erscheinungsarten können alle übrigen hervorgebracht werden . . .

Vermöge der Kraft des Armes reiss man die Inductionstrolche von einem Magneten los, es entsteht in dem darum geschlungenen Schraubendrahte ein electrischer Strom, welcher bei Unterbrechung als Funke, oder bei verengter Leitung als glühender Draht (*Wärme und Licht*) erscheint; derselbe erregt magnetische Polarität, wenn er als Schraubendraht um eine Stahlnadel geleitet wird; er versetzt das Wasser wodurch er geleitet wird, und hebt zugleich seine Affinität und Cohäsion auf; und da nun der dünne Platindraht, die Ampèresche Schraube und der Wasserzersetzungssapparat gleichzeitig in derselben Kette eingeschlossen sein können, so leuchtet ein, wie die Kraft, der Armes unter verschiedenen Verhältnissen als Wärme, Licht, Chemische Affinität, Magnetismus und Cohäsion zum Vorschein gekommen ist. (Baumgartner's Zeitschr. f. Physik, &c. Vol. V., s. 442-43.)

"With a modesty that contrasts strongly with the severe language used by PROF. TAIT, he continues :

'To claim priority by insisting on former labors and successes seems to me inadmissible ; but nobody will be able to disclaim an essay, printed with its date in a scientific periodical, since even unpublished papers, if they have their date reliably fixed, are deemed admissible for the purpose.⁹

"And refraining with considerate carefulness from making a direct or even implied charge of plagiarism, such as DUHRING made against HELMHOLTZ and TAIT makes against MAYER, he concludes :

'If a scientist has deposited with an Academy or left with the publisher of some periodical an article with its date in a sealed envelope, he can at any time afterwards prove his claim of priority by opening it ; the second discoverer is, however, then justified in declaring that he had not and could not have had any knowledge of the contents of that letter ; *this he cannot say of a periodical regularly published and accessible to everybody.*¹⁰

PROF. TAIT commits an error in supposing that the original paper by MOHR was published in Liebig's *Annalen der Chemie*. This is probably due to the fact that in the *Annalen der Pharmacie*, of which MOHR was an associate editor, a short synopsis of his paper appeared under the general heading of a "*Revue für das Jahr 1837.*" (24, 141), bearing the same title, "*Ueber die Natur der Wärme.*" The charge of plagiarism which TAIT distinctly and deliberately makes on the supposed fact that MAYER's essay appeared in the same *Annalen* where MOHR's original paper was printed, can no longer be sustained ; and one may reasonably hope henceforth to hear of it no more. It should never have been uttered.

In conclusion, it may be stated that, in thus presenting for the first time in the columns of "SCIENCE" the complete documentary evidence of Prof. MOHR's priority in regard to the discovery of the great principle of the correlation of forces and the conservation of energy, we have been actuated by no other motive than that which underlies all science, viz.: to seek and proclaim the truth and nothing but the truth, and at the same time to do justice to whom justice is due. And no man deserves more to be accorded an honor which he is entitled to than FRIEDRICH MOHR, whose rare genius and masterly mind never betrayed him into committing such errors of judgment as may be laid at the door of almost every other writer on the subject.

WYANDOTTE GOVERNMENT,

A SHORT STUDY OF TRIBAL SOCIETY, DELIVERED AT THE BOSTON MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AUGUST 1, 1880.

By MAJOR J. W. POWELL, Director, Bureau of Ethnology, Washington.

In the social organization of the Wyandottes four groups are recognized, the family, the gens, the phratry, and the tribe.

THE FAMILY.

The family, as the term is here used, is nearly synonymous with the household. It is composed of the persons who occupy one lodge, or in their permanent wigwams, one section of a communal dwelling. These permanent dwellings are constructed in an oblong form of poles interwoven with bark. The fire was placed in line along

the centre, and was usually built for two families, one occupying the place on each side of the fire.

The head of the family is a woman.

GENS.

The gens is an organized body of consanguineal kindred in the female line. "The woman carries the gens;" is the formulated statement by which a Wyandotte expresses the idea that descent is in the female line. Each gens has the name of some animal, the ancient of such animal being its tutelary god. Up to the time when the tribe left Ohio, eleven gentes were recognized, as follows:

Deer, Bear, Highland Turtle (striped), Highland Turtle (black), Mud Turtle, Smooth Large Turtle, Hawk, Beaver, Wolf, Sea Snake, and Porcupine.

In speaking of an individual he is said to be a Wolf, a Bear, or Deer, as the case may be, meaning thereby that he belongs to that gens ; but in speaking of the body of people comprising a gens they are said to be relatives of the Wolf, the Bear, or the Deer, as the case may be.

There is a body of names belonging to each gens, so that each person's name indicates the gens to which he belongs. These names are derived from the characteristics, habits, attitudes, or mythologic stories connected with the tutelary god.

The following schedule presents the name of a man and woman in each gens as illustrating this statement :

	Indian.	English.
Man of Deer gens	De-wa-ti-re	Lean Deer
Woman " "	A-ya-jin-ta	Spotted Fawn
Man of Bear " "	A-tu-e-tes	Long Claws
Woman of Bear " "	Tsa'-man'-da-ka-e'	Grunting for her Young
Man of Striped Turtle gens	Ta-ha'-so'-ta-ra-ta-se	Going Around the Lake
Woman of Striped Turtle gens	Tso-we-yuñ-kyn	Gone from the Water
Man of Mud Turtle gens	Sha-yan-tsu-wat'	Hard Skull
Woman of Mud Turtle gens	Ya ⁿ -däsh-shu-räs	Finding Sand Beach
Man of Smooth Large Turtle gens	Hu ⁿ -'du-cu-tá	Throwing Sand
Woman of Smooth Large Turtle gens	Tsu-ca-e ⁿ '	Slow Walker
Man of Wolf gens	Ha-ro'-u ⁿ -yü	One Who goes About in the Dark'a Prowler
Woman " "	Ya ⁿ -di-no	Always Hungry
Man of Snake gens	Hu-ta-hu'-sa	Sitting in Curled Position
Woman " "	Di-je-rons	One Who Ripples the Water
Man of Porcupine gens	Ha ⁿ -du-'tu ⁿ	The One Who Puts Up Quills
Woman of Porcupine gens	Ke'-ya-runs-kwa	Good-Sighted

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There are four phratries in the tribe, the three gentes Bear, Deer, and Striped Turtle constituting the first ; the Highland Turtle, Black Turtle, and Smooth Large Turtle the second ; the Hawk, Beaver, and Wolf the third ; and the Sea Snake and Porcupine the fourth.

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a son, brother, or some definite relative; and this artificial relationship gives him the same standing as actual relationship in the family, in the gens, in the phratry and in the tribe.

Thus a tribe is a body of kindred.

Of the four groups thus described, the gens, the phratry and the tribe constitute the series of organic units; the family or household as here described, is not a unit of the gens or phratry, as two gentes are represented in each—the father must belong to one gens and the mother and her children to another.

GOVERNMENT.

Society is maintained by the establishment of government, for rights must be recognized and duties performed.

In this tribe there is found a complete differentiation of the military from the civil government.

CIVIL GOVERNMENT.

The civil government inheres in a system of councils and chiefs.

In each gens there is a council, composed of four women, called Yu-wai-yu-wá-na. These four women councillors select a chief of the gens from its male members—that is, from their brothers and sons. This gentile chief is the head of the gentile council.

The council of the tribe is composed of the aggregated gentile councils. The tribal council, therefore, is composed one-fifth of men and four-fifths of women.

The sachem of the tribe or tribal chief is chosen by the chiefs of the gentes.

There is sometimes a grand council of the gens, composed of the councillors of the gens proper and all the heads of households and leading men—brothers and sons.

There is also sometimes a grand council of the tribe, composed of the council of the tribe proper and the heads of households of the tribe and all the leading men of the tribe.

These grand councils are convened for special purposes.

METHODS OF CHOOSING AND INSTALLING COUNCILLORS AND CHIEFS.

The four women councillors of the gens are chosen by the heads of households—themselves being women. There is no formal election, but frequent discussion is had over the matter from time to time, in which a sentiment grows up within the gens and throughout the tribe that, in the event of the death of any councillor, a certain person will take her place.

In this manner there is usually one, two or more potential councillors in each gens who are expected to attend all the meetings of the council, though they take no part in the deliberations and have no vote.

When a woman is installed as councillor a feast is prepared by the gens to which she belongs, and to this feast all the members of the tribe are invited. The woman is painted and dressed in her best attire, and the sachem of the tribe places upon her head the gentile chaplet of feathers, and announces in a formal manner to the assembled guests that the woman has been chosen a councillor. The ceremony is followed by feasting and dancing, often continued late into the night.

The gentile chief is chosen by the council women after consultation with the other women and men of the gens. Often the gentile chief is a potential chief through a period of probation. During this time he attends the meetings of the council, but takes no part in their deliberations, and has no vote.

At his installation, the council women invest him with an elaborately ornamented tunic, place upon his head a chaplet of feathers, and paint the gentile totem on his face. The sachem of the tribe then announces to the people that the man has been made chief of the gens, and admitted to the council. This is also followed by a festival.

The sachem of the tribe is selected by the men belonging to the council of the tribe. Formerly the sachemship inhered in the Bear gens but at present he is chosen from the Deer gens from the fact, as the Wyandottes say, that death has carried away all the wise men of the Bear gens.

The chief of the Wolf gens is the herald and sheriff of the tribe. He superintends the erection of the council house, and has the care of it. He calls the council together in a formal manner when directed by the sachem. He announces to the tribe all the decisions of the council, and executes the directions of the council and of the sachem.

Gentile councils are held frequently from day to day and from week to week, and are called by the chief whenever deemed necessary. When matters before the council are considered of great importance, a grand council of the gens may be called.

The tribal council is held regularly on the night of the full moon of each lunation and at such other times as the sachem may determine; but extra councils are usually called by the sachem at the request of a number of councillors.

Meetings of the gentile councils are very informal; but the meetings of the tribal councils are conducted with due ceremony. When all the persons are assembled, the chief of the Wolf gens calls them to order, fills and lights a pipe, sends one puff of smoke to the heavens and another to the earth. The pipe is then handed to the sachem who fills his mouth with smoke, and, turning from left to right with the sun, slowly puffs it out over the heads of the councillors who are sitting in a circle. He then hands the pipe to the man on his left, and it is smoked in turn by each person until it has been passed around the circle. The sachem then explains the object for which the council is called. Each person in the way and manner he chooses, tells what he thinks should be done in the case. If a majority of the council is agreed as to action, the sachem does not speak, but may simply announce the decision. But in some cases there may be protracted debate which is carried on with great deliberation. In case of a tie, the sachem is expected to speak.

It is considered dishonorable for any man to reverse his decision after having spoken.

Such are the organic elements of the Wyandotte government.

FUNCTIONS OF CIVIL GOVERNMENT.

It is the function of government to preserve rights and enforce the performance of duties. Rights and duties are co-relative. Rights imply duties, and duties imply rights. The right inhering in the party of the first part imposes a duty on the party of the second part. The right and its co-relative duty are inseparable parts of a relation that must be maintained by government; and the relations which governments are established to maintain may be treated under the general head of rights.

In Wyandotte government, these rights may be classed as follows:

First:—Rights of marriage.

Second:—Rights to names.

Third:—Rights to personal adornments.

Fourth:—Rights of order in encampments and migrations.

Fifth:—Rights of property.

Sixth:—Rights of person.

Seventh:—Rights of community.

Eighth:—Rights of religion.

To maintain rights, rules of conduct are established, not by formal enactment but by regulated usage. Such custom-made laws may be called regulations.

MARRIAGE REGULATION.

Marriage between members of the same gens is forbidden, but consanguinal marriages between persons of different gentes are permitted. For example, a man may not marry his mother's sister's daughter, as she belongs to the same gens with himself; but he can marry his father's sister's daughter, because she belongs to a different gens.

Husbands retain all their rights and privileges in their own gentes, though they live with the gentes of their wives. Children, irrespective of sex, belong to the gens of the mother. Men and women must marry within the tribe. A woman taken to wife from without the tribe, must first be adopted into some family of a gens other than that to which the man belongs. That a woman may take for a husband a man without the tribe, he must also be adopted into the family of some gens other than that of the woman. What has been called by some ethnologists endogamy and exog-

amy, are correlative parts of one regulation, and the Wyandottes, like all other tribes of which we have any knowledge in North America, are both endogamous and exogamous.

Polygamy is permitted, but the wives must belong to different gentes. The first wife remains the head of the household. Polyandria is prohibited. A man seeking a wife consults her mother, sometimes direct, and sometimes through his own mother. The mother of the girl advises with the women councillors to obtain their consent, and the young people usually submit quietly to their decision. Sometimes the women councillors consult with the men.

When a girl is betrothed, the man makes such presents to the mother as he can. It is customary to consummate the marriage before the end of the moon in which the betrothal is made. Bridegroom and bride make promises of faithfulness to the parents and women councillors of both parties. It is customary to give a marriage feast in which the gentes of both parties take part. For a short time at least, bride and groom live with the bride's mother, or rather in the original household of the bride.

The time when they will set up housekeeping for themselves is usually arranged before marriage.

In the event of the death of the mother the children belong to her sister or to her nearest female kin, the matter being settled by the council women of the gens. As the children belong to the mother, on the death of the father the mother and children are cared for by her nearest male relative until subsequent marriage.

NAME REGULATIONS.

It has been previously explained that there is a body of names, the exclusive property of each gens. Once a year, at the green-corn festival, the council women of the gens select the names for the children born during the previous year, and the chief of the gens proclaims these names at the festival. No person may change his name, but every person, man or woman, by honorable or dishonorable conduct, or by remarkable circumstance, may win a second name commemorative of deed or circumstance, which is a kind of title.

REGULATIONS OF PERSONAL ADORNMENT.

Each clan has a distinctive method of painting the face, a distinctive chaplet to be worn by the gentile chief and council women when they are inaugurated, and subsequently at festival occasions, and distinctive ornaments for all its members, to be used at festivals and religious ceremonies.

REGULATIONS OF ORDER IN ENCAMPMENT AND MIGRATIONS.

The camp of the tribe is in an open circle or horse-shoe, and the gentes camp in the following order, beginning on the left and going around to the right:

Deer, Bear, Highland Turtle (striped), Highland Turtle (black), Mud Turtle, Smooth Large Turtle, Hawk, Beaver, Wolf, Sea Snake, Porcupine.

The order in which the households camp in the gentile group is regulated by the gentile councillors and adjusted from time to time in such a manner that the oldest family is placed on the left, and the youngest on the right. In migrations and expeditions the order of travel follows the analogy of encampment.

PROPERTY RIGHTS.

Within the area claimed by the tribe each gens occupies a smaller tract for the purpose of cultivation. The right of the gens to cultivate a particular tract is a matter settled in the council of the tribe, and the gens may abandon one tract for another only with the consent of the tribe. The women councillors partition the gentile land among the householders, and the household tracts are distinctly marked by them. The ground is re-partitioned once in two years. The heads of households are responsible for the cultivation of the tract, and should this duty be neglected the council of the gens calls the responsible parties to account.

Cultivation is communal; that is, all of the able-bodied women of the gens take part in the cultivation of each household tract in the following manner:

The head of the household sends her brother or son into the forest or to the stream to bring in game or fish for a feast; then the able-bodied women of the gens are invited to assist in the cultivation of the land, and when this work is done a feast is given.

The wigwam or lodge and all articles of the household belong to the woman—the head of the household—and at her death are inherited by her eldest daughter, or nearest of female kin. The matter is settled by the council women. If the husband die his property is inherited by his brother or his sister's son, except such portion as may be buried with him. His property consists of his clothing, hunting and fishing implements and such articles as are used personally by himself.

Usually a small canoe is the individual property of the man. Large canoes are made by the male members of the gentes, and are the property of the gentes.

RIGHTS OF PERSON.

Each individual has a right to freedom of person and security from personal and bodily injury, unless adjudged guilty of crime by proper authority.

COMMUNITY RIGHTS.

Each gens has the right to the services of all its women in the cultivation of the soil. Each gens has the right to the service of all its male members in avenging wrongs, and the tribe has the right to the service of all its male members in time of war.

RIGHTS OF RELIGION.

Each phratry has the right to certain religious ceremonies and the preparation of certain medicines.

Each gens has the exclusive right to worship its tutelary god, and each individual has the exclusive right to the possession and use of a particular amulet.

CRIMES.

The violations of rights are crimes. Some of the crimes recognized by the Wyandottes are as follows:

- | | |
|--------------|----------------|
| 1. Adultery. | 4. Murder. |
| 2. Theft. | 5. Treason. |
| 3. Maiming. | 6. Witchcraft. |

A maiden guilty of fornication may be punished by her mother or female guardian, but if the crime is flagrant and repeated, so as to become a matter of general gossip, and the mother fails to correct it, the matter may be taken up by the council women of the gens.

A woman guilty of adultery, for the first offence is punished by having her hair cropped; for repeated offences her left ear is cut off.

THEFT.

The punishment for theft is two-fold restitution. When the prosecutor and prosecuted belong to the same gens, the trial is before the council of the gens, and from it there is no appeal. If the parties involved are of different gentes, the prosecutor, through the head of his household, lays the matter before the council of his own gens; by it the matter is laid before the gentile council of the accused in a formal manner. Thereupon it becomes the duty of the council of the accused to investigate the facts for themselves, and to settle the matter with the council of the plaintiff. Failure thus to do is followed by retaliation in the seizing of any property of the gens which may be found.

MAIMING.

Maiming is compounded, and the method of procedure in prosecution is essentially the same as for theft.

MURDER.

In the case of murder, if both parties are members of the same gens, the matter is tried by the gentile council on complaint of the head of the household, but there may be an appeal to the council of the tribe. Where the parties belong to different gentes, complaint is formally made by the injured party, through the chief of his gens, in the following manner:

A wooden tablet is prepared upon which is inscribed the totem or heraldic emblem of the injured man's gens, and a picture writing setting forth the offence follows.

The gentile chief appears before the chief of the council of the offender, and formally states the offence, explaining the picture-writing, which is then delivered.

A council of the offender's gens is thereupon called and a trial is held. It is the duty of this council to examine the evidence for themselves and to come to a conclusion without further presentation of the matter on the part of the person aggrieved. Having decided the matter among themselves, they appear before the chief of the council of the aggrieved party to offer compensation.

If the gens of the offender fail to settle the matter with the gens of the aggrieved party, it is the duty of his nearest relative to avenge the wrong. Either party may appeal to the council of the tribe. The appeal must be made in due form, by the presentation of a tablet of accusation.

Inquiry into the effect of a failure to observe prescribed formalities developed an interesting fact. In procedure against crime, failure in formality is not considered a violation of the rights of the accused, but proof of his innocence. It is considered supernatural evidence that the charges are false. In trials for all offences forms of procedure are, therefore, likely to be earnestly questioned.

TREASON.

Treason consists in revealing the secrets of the medicine preparations or giving other information or assistance to enemies of the tribe, and is punished by death. The trial is before the council of the tribe.

WITCHCRAFT.

Witchcraft is punished by death, stabbing, tomahawking, or burning. Charges of witchcraft are investigated by the grand council of the tribe. When the accused is adjudged guilty, he may appeal to supernatural judgment. The test is by fire. A circular fire is built on the ground through which the accused must run from east to west, and from north to south. If no injury is received, he is adjudged innocent; if he falls into the fire, he is adjudged guilty. Should a person accused or having the general reputation of practising witchcraft become deaf, blind, or have sore eyes, ear ache, headache, or other diseases considered loathsome, he is supposed to have failed in practising his arts upon others and to have fallen a victim to them himself. Such cases are most likely to be punished.

OUTLAWRY.

The institution of outlawry exists among the Wyandottes in a peculiar form. An outlaw is one who by his crimes has placed himself without the protection of his clan. A man can be declared an outlaw by his own clan, who thus publish to the tribe that they will not defend him in case he is injured by another. But, usually, outlawry is declared only after trial before the tribal council.

The method of procedure is analogous to that in case of murder. When the person has been adjudged guilty, and sentence of outlawry declared, it is the duty of the chief of the Wolf clan to make known the decision of the council. This he does by appearing before each clan in the order of its encampment, and declaring in terms the crimes of the outlaw and the sentence of outlawry, which may be either of two grades.

In the lowest grade it is declared that, if the man shall thereafter continue in the commission of similar crimes, it will be lawful for any person to kill him; and if killed, rightfully or wrongfully, his clan will not avenge his death.

Outlawry of the highest degree makes it the duty of any member of the tribe who may meet with the offender to kill him.

MILITARY GOVERNMENT.

The management of military affairs inheres in the military council and chief. The military council is composed of all the able-bodied men of the tribe; the military chief is chosen by the council from the Porcupine gens. Each gentile chief is responsible for the military training of the youth under his authority. There is usually one or more

potential military chiefs who are the close companions and assistants of the chief in time of war, and in case of the death of the chief take his place in the order of seniority.

Prisoners of war are adopted into the tribe or killed. To be adopted into the tribe it is necessary that the prisoner should be adopted into some family. The warrior taking the prisoner has the first right to adopt him, and his male or female relatives have the right in the order of their kinship. If no one claims the prisoner for this purpose he is caused to run the gauntlet, as a test of his courage.

If at his trial he behaves manfully, claimants are not wanting, but if he behaves disgracefully he is put to death.

FELLOWHOOD.

There is an interesting institution found among the Wyandottes, as among some other of our North American tribes, namely, that of fellowhood. Two young men agree to be perpetual friends to each other, or more than brothers. Each reveals to the other the secrets of his life, and counsels with him on matters of importance, and defends him from wrong and violence, and at his death is chief mourner.

The government of the Wyandottes, with the social organization upon which it is based, affords a typical example of tribal Government throughout North America. Within that area there are several hundred distinct governments. In so great a number there is great variety, and in this variety we find different degrees of organization, the degree of organization being determined by the differentiation of the functions of government and the correlative specialization of organic elements.

Much has yet to be done in the study of these governments before safe generalizations may be made. But enough is known to warrant the following statement.

Tribal government in North America is based on kinship in that the fundamental units of social organization are bodies of consanguineal kindred either in the male or female line: these units being what has been well denominated "gentes."

These "gentes" are organized into tribes by ties of relationship and affinity, and this organization is of such a character that the man's position in the tribe is fixed by his kinship. There is no place in a tribe for any person whose kinship is not fixed, and only those persons can be adopted into the tribe who are adopted into some family with artificial kinship specified. The fabric of Indian society is a complex tissue of kinship. The warp is made of streams of kinship blood, and the woof of marriage ties.

With most tribes military and civil affairs are differentiated. The functions of civil government are in general differentiated only to this extent, that executive functions are performed by chiefs and sachems, but these chiefs and sachems are also members of the council. The council is legislature and court. Perhaps it were better to say that the council is the court whose decisions are law, and that the legislative body properly has not been developed.

In general crimes are well defined. Procedure is formal, and forms are held as of such importance that error therein is *prima facie* evidence that the subject matter formulated was false.

When one gens charges crime against a member of another, it can of its own motion proceed only to retaliation. To prevent retaliation, the gens of the offender must take the necessary steps to disprove the crime, or to compound or punish it. The charge once made is held as just and true until it has been disproved, and in trial the cause of the defendant is first stated. The anger of the prosecuting gens must be placated.

In the tribal governments there are many institutions, customs, and traditions which give evidence of a former condition in which society was based, not upon kinship, but upon marriage.

From a survey of the facts it seems highly probable that kinship society, as it exists among the tribes of North America, has developed from consanguineal society, which is discovered elsewhere on the globe. In fact, there are few tribes that seem scarcely to have passed that indefinite boundary between the two social states. Philologic research leads to the same conclusion.

Nowhere in North America have a people been discov-

ered who have passed beyond tribal society to national society based on property, *i.e.*, that form of society which is characteristic of civilization. Some peoples may not have reached kinship society; none have passed it.

Nations with civilized institutions, art with palaces, monotheism as the worship of the Great Spirit, all vanish from the priscan condition of North America in the light of anthropologic research.

Tribes, with the social institutions of kinship, art with its highest architectural development exhibited in the structure of communal dwellings, and polytheism in the worship of mythic animals and nature-gods, remain.

THE GENESIS OF CERTAIN IRON ORES.*

By DR. T. STERRY HUNT, LL. D., F.R.S.

Dr. Hunt began by considering the presence of iron, generally in a ferrous condition, in mineral silicates, in the crystalline rocks, and its liberation therefrom by the sub-aerial decay of these as hydrous ferric oxide. This, as is well known, is, by the agency of organic matter, again reduced to ferrous oxide, which is dissolved in natural waters by carbonic acid or some organic acid, from which solutions it may be deposited either as hydrous peroxide (limonite, etc.) as carbonate (siderite), as silicate, or as sulphide (pyrite, etc.), in all of which forms iron is found in sedimentary deposits. As regards the formation of siderite, he described experiments which show that solutions holding five grammes of ferrous carbonate dissolved as di-carbonate in a litre of water, are spontaneously decomposed in close vessels at the ordinary temperature, and deposit two-thirds of their iron as a white crystalline (hydrated) mono-carbonate, with liberation of carbonic-dioxide. This serves to render more intelligible the reduction and segregation of iron as siderite in earthy sediments, as long since pointed out by W. B. Rogers, for the ores of the coal-measures.

The intervention of soluble sulphates, and their reduction through organic agency to sulphides, determines the formation of sulphide of iron in sediments. The generation of a bi-sulphide (pyrite or marcasite) was then discussed, and it was shown that the ferrous mono-sulphide, which naturally is first generated, may fix a further portion of sulphur and thus form a more stable compound. One example of this is seen when recently precipitated hydrous ferrous sulphide is brought in contact with a solution of a ferric salt, which takes up a portion of the iron, leaving sulphur free to unite with the undecomposed sulphide, and form therewith a very stable higher sulphide of iron. Experiments now in progress lead the writer to believe that sulphur liberated from soluble sulphides may, in a similar manner, unite with ferrous sulphide, and thus help us to explain the generation of pyrites in nature, in the presence of water, at ordinary temperatures.

The changes of siderite and pyrite under atmospheric influences were next considered. The latter by oxidation yields, as is well known, ferrous sulphate. Its frequent conversion by sub-aerial decay into limonite was conceived to be due to the intervention of water, holding carbonates, which, conjointly with oxygen, changes it into hydrous peroxide (limonite), which often retains the form of the pyrites. The transformation of carbonate of iron into hydrous peroxide is a familiar fact.

Limonite ores may thus be produced in three ways. They are sometimes formed by the peroxidation and precipitation of dissolved ferrous salts, as in the so-called bog-ores; but more frequently from the alteration *in situ* of deposits of pyrite or of siderite. Such are the limonites which mark the outcrops of beds or veins of pyrites in the decayed crystalline rocks of the Blue Ridge. The similar ores found in the decayed Taconic schists of the great Appalachian valley can be shown to be due in some cases to the alteration of included pyritous masses, and in others to the alteration of similar masses of siderite, both of which are found in the unaltered Taconic rocks, as, indeed, at various other horizons in the geological series.

If we take the specific gravity of pyrites at 5.0, we shall find that its complete conversion into a limonite of sp. gr.

4.0 would be attended with a contraction of only 2.7 hundredths, while if the limonite have a sp. gr. of 3.6, there would be an augmentation of 10.7 p. c. With siderite of sp. gr. 3.6, on the contrary, its conversion into limonite of the same density would result in a contraction of 19.5 p. c., and into lemonite of sp. gr. 4.0 to a contraction of 27.5 p. c. The evidences of this contraction may be seen in the structure of the limonite derived from siderite. The process operates from the surface of the masses, often resulting in the production of geodes. Their structure will generally serve to distinguish the sideritic from the pyritic limonites.

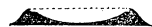
These differences were illustrated in the history of various iron ores in the Appalachian valley, and it was further pointed out that the pyritic limonites, other circumstances being equal, should be freer from phosphorus than those derived from siderite, since the native carbonates almost always contain phosphates, from which pyritous deposits are comparatively free. The source of limonites thus becomes a question of importance to the metallurgist. In conclusion it was pointed out that deposits of manganese ores are, in some cases at least, generated by the alteration *in situ* of manganese carbonates, by a process analogous to that by which limonite is produced from siderite.—

MICROSCOPY.

NEW CELL FOR OPAQUE OBJECTS.

I desire to call the attention of the microscopists and preparers of objects generally to the new rubber cell for opaque slides, recently devised by me. A considerable experience in mounting opaque slides during the past few years has convinced me that much of the labor incident to it could be avoided, if a cell of suitable material and shape could be produced at a nominal cost. This, I think, has now been attained, and I take pleasure in submitting one for which I claim convenience, cheapness, and general utility. With it the amateur can produce a slide fully as perfect, and with as great a degree of neatness as can the professional. The cell is of hard rubber, highly polished, and of attractive shape; the base is solid, thus giving a black back-ground of rubber; around the top is a ledge fitted to receive a one-half inch cover glass; this, being secured by a little shellac or any similar cement, completes the mounting. The cell may be attached to a glass slip by any cement, before or after preparation. For exchanges it offers superior advantages, inasmuch as the cell, with objects enclosed, may be sent through the mails independent of the glass slips, the recipient attaching them. In this way a saving is made in postage, and no risk of loss by slips being broken in transit.

They will solve the problem which often perplexes the student or collector who is crowded for cabinet room. Many objects for future reference may be mounted in this simple cell, numbered and put away without a slide, a cabinet drawer holding two hundred of them, while but forty slides could be accommodated in the same space.



The above sectional view conveys a good idea of its shape, the dotted line indicating the position of the thin glass cover.

I have made arrangements to have them supplied by the following firms at thirty cents per dozen, five cents extra on single dozens to cover cost of postage and box, and they may be obtained from the parties mentioned below or from the subscriber. In remitting small sums three cent postage stamps may be used.

GEO. S. WOOLMAN, No. 116 Fulton St., New York; JAS. W. QUEEN & Co., Chestnut St., Philadelphia; BAUSCH & DRANSFIELD, Arcade, Rochester, N. Y.; W. H. BULLOCK, No. 126 So. Clark St., Chicago, Ills.

In conclusion I would add that I have had these rubber cells prepared without regard to any pecuniary gain to myself, hoping they may prove an aid to those engaged in microscopical research.

H. F. ATWOOD,

No. 50 Hamilton Place, Rochester, N. Y.

[We have seen a sample of Mr. Atwood's rubber cell, and consider it a very perfect arrangement for opaque objects.—ED.]

* Read before the A. A. S., Boston, 1880.

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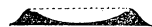
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No. 50 Hamilton Place, Rochester, N. Y.

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ered who have passed beyond tribal society to national society based on property, *i.e.*, that form of society which is characteristic of civilization. Some peoples may not have reached kinship society; none have passed it.

Nations with civilized institutions, art with palaces, monotheism as the worship of the Great Spirit, all vanish from the priscan condition of North America in the light of anthropologic research.

Tribes, with the social institutions of kinship, art with its highest architectural development exhibited in the structure of communal dwellings, and polytheism in the worship of mythic animals and nature-gods, remain.

THE GENESIS OF CERTAIN IRON ORES.*

By DR. T. STERRY HUNT, LL. D., F.R.S.

Dr. Hunt began by considering the presence of iron, generally in a ferrous condition, in mineral silicates, in the crystalline rocks, and its liberation therefrom by the sub-aerial decay of these as hydrous ferric oxide. This, as is well known, is, by the agency of organic matter, again reduced to ferrous oxide, which is dissolved in natural waters by carbonic acid or some organic acid, from which solutions it may be deposited either as hydrous peroxide (limonite, etc.) as carbonate (siderite), as silicate, or as sulphide (pyrite, etc.), in all of which forms iron is found in sedimentary deposits. As regards the formation of siderite, he described experiments which show that solutions holding five grammes of ferrous carbonate dissolved as di-carbonate in a litre of water, are spontaneously decomposed in close vessels at the ordinary temperature, and deposit two-thirds of their iron as a white crystalline (hydrated) mono-carbonate, with liberation of carbonic-dioxide. This serves to render more intelligible the reduction and segregation of iron as siderite in earthy sediments, as long since pointed out by W. B. Rogers, for the ores of the coal-measures.

The intervention of soluble sulphates, and their reduction through organic agency to sulphides, determines the formation of sulphide of iron in sediments. The generation of a bi-sulphide (pyrite or marcasite) was then discussed, and it was shown that the ferrous mono-sulphide, which naturally is first generated, may fix a further portion of sulphur and thus form a more stable compound. One example of this is seen when recently precipitated hydrous ferrous sulphide is brought in contact with a solution of a ferric salt, which takes up a portion of the iron, leaving sulphur free to unite with the undecomposed sulphide, and form therewith a very stable higher sulphide of iron. Experiments now in progress lead the writer to believe that sulphur liberated from soluble sulphides may, in a similar manner, unite with ferrous sulphide, and thus help us to explain the generation of pyrites in nature, in the presence of water, at ordinary temperatures.

The changes of siderite and pyrite under atmospheric influences were next considered. The latter by oxidation yields, as is well known, ferrous sulphate. Its frequent conversion by sub-aerial decay into limonite was conceived to be due to the intervention of water, holding carbonates, which, conjointly with oxygen, changes it into hydrous peroxide (limonite), which often retains the form of the pyrites. The transformation of carbonate of iron into hydrous peroxide is a familiar fact.

Limonite ores may thus be produced in three ways. They are sometimes formed by the peroxidation and precipitation of dissolved ferrous salts, as in the so-called bog-ores; but more frequently from the alteration *in situ* of deposits of pyrite or of siderite. Such are the limonites which mark the outcrops of beds or veins of pyrites in the decayed crystalline rocks of the Blue Ridge. The similar ores found in the decayed Taconic schists of the great Appalachian valley can be shown to be due in some cases to the alteration of included pyritous masses, and in others to the alteration of similar masses of siderite, both of which are found in the unaltered Taconic rocks, as, indeed, at various other horizons in the geological series.

If we take the specific gravity of pyrites at 5.0, we shall find that its complete conversion into a limonite of sp. gr.

4.0 would be attended with a contraction of only 2.7 hundredths, while if the limonite have a sp. gr. of 3.6, there would be an augmentation of 10.7 p. c. With siderite of sp. gr. 3.6, on the contrary, its conversion into limonite of the same density would result in a contraction of 19.5 p. c., and into lemonite of sp. gr. 4.0 to a contraction of 27.5 p. c. The evidences of this contraction may be seen in the structure of the limonite derived from siderite. The process operates from the surface of the masses, often resulting in the production of geodes. Their structure will generally serve to distinguish the sideritic from the pyritic limonites.

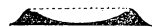
These differences were illustrated in the history of various iron ores in the Appalachian valley, and it was further pointed out that the pyritic limonites, other circumstances being equal, should be freer from phosphorus than those derived from siderite, since the native carbonates almost always contain phosphates, from which pyritous deposits are comparatively free. The source of limonites thus becomes a question of importance to the metallurgist. In conclusion it was pointed out that deposits of manganese ores are, in some cases at least, generated by the alteration *in situ* of manganese carbonates, by a process analogous to that by which limonite is produced from siderite.—

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THE TWO KINDS OF VIVISECTION—SENTISECTION AND CALLISECTION.

Professor BURT G. WILDER, M. D., of Cornell University, writing to the *Medical Record*, says: Is it not time for the distinct verbal recognition of the difference between painful and painless experimentation upon animals?

All well-informed persons are aware that the vast majority of vivisections, in this country at least, are performed under the influence of anæsthetics; but the enthusiastic zoölaters, who desire to abolish the objective method of teaching physiology, practically ignore this fact, and dwell chiefly upon the comparatively infrequent operations which are attended with pain.

Having read the arguments upon both sides, and had some correspondence with leaders of the anti-vivisection movement, I have been led to think that the discussion may be simplified, and a right conclusion sooner reached, if we adopt new terms corresponding to the two kinds of experimentation.

To use words with no warrant of ideas may be foolish, but it is not necessarily a mark of wisdom to refrain from the employment of terms which have a real significance.

Let us consider an analogous case. Aside from color and size, the *cat* and the *leopard* are almost identical, and are commonly regarded as two species of one genus. Suppose a community to be unacquainted with the cat, but to have suffered from the depredations of the leopard, which they call *felis*. Now, suppose some domestic cats to be introduced and to multiply, as is their wont. In the first place, for a time at least, it is probable that the same name, *felis*, would be applied to the smaller animal, with perhaps a qualifying word. In the second place, should there be certain persons, both devoid of interest in the cats and filled with pity for the mice devoured by them, is it not likely that they would endeavor to include the cats under any ban which might be pronounced against the leopards? Would they not be apt to succeed, especially with the more ignorant and impressionable members of the community, so long as they could assert without contradiction that the "mouse-eater" it was only a *felis* upon a smaller scale? Would not even the reputation of the leopards suffer by reason of the multitude of the cats thus associated with them? In short, would full justice be done to either animal until their differences of disposition should be admitted to outweigh their likeness of form and structure, and be recognized by the use of distinctive names?

In like manner there are those who ignorantly or wilfully persuade themselves and others that all experiments upon animals are painful because some of them are now, and most of them were in former times; also, that painful experiments are common because vivisection in some form is generally practiced. It is all *vivisection*, and as such it is "cruel, revolting, or brutalizing."

Having waited long in the hope that some candid discussion of the whole subject might contain the needed terms, I venture to suggest that painful vivisection be known as *sentisection*, and painless vivisection as *callisection*. The etymology of the former word is obvious; the distinctive element of the latter is the Latin *callus*, which in a derived sense, may denote a nervous condition unrecognized, strictly speaking, by the ancients.

Some idea of the relative numbers of callisectionists and sentisectionists may be gained from the fact that I have been teaching physiology in a university for twelve years, and for half that time in a medical school; yet I have never performed a sentisection, unless under that head should be included the drowning of cats and the application of water at the temperature of 60° C. (140° F.), with the view to ascertain whether such treatment would be likely to succeed with human beings.

I think that even elementary physiological instruction is incomplete without callisection, but that sentisection should be the unwelcome prerogative of the very few whose natural and acquired powers of body and mind qualify them above others to determine what experiments should be done, to perform them properly, and to wisely interpret the results. Such men, deserving alike of the highest honor and the deepest pity, should exercise their solemn office not only unrestrained by law, but upheld by the general sentiment of the profession and the public.

FEELING AND FUNCTION AS FACTORS IN HUMAN DEVELOPMENT.*

BY LESTER F. WARD, A. M.

Sociology is now recognized as a legitimate branch of Anthropology.

The great French philosopher, Auguste Comte, although the first to introduce the word *Sociology*, did not venture to use this term extensively himself, but preferred the expression *Social Physies*, which must therefore be accepted as the true definition of sociology as intended by the father of the science.

It is important to remember this fact and to preserve throughout this necessary connection between social science and physical science. This, however, has not always been done. The phenomena of human development, may be contemplated from two quite distinct points of view, only one of which has thus far received sufficient attention. These two points of view are those respectively of feeling and of function, and it is the first of them that has been neglected. According to the usual method of approaching such questions, man is regarded as a being requiring for his preservation a certain amount of nourishment and for his perpetuation the begetting of offspring. The two essential factors from this point of view are the functions of nutrition and reproduction. Around the first of these cluster the industrial activities, and upon the second is founded the family. Out of these grow all the later and more complex characteristics of civilization. According to the other method of contemplating human development, man is regarded as a being endowed with feelings. These feelings are in the nature of desires. The existence of such desires involves the effort to gratify them, which effort in turn gives rise to human activities. The condition of society at any time is the result of these activities, just as from the point of view of function, nutrition and reproduction are the two primary essential factors; so, from the point of view of feeling, the gustatory and sexual appetites are the primary and essential factors. The advantage of the latter method over the former is that it affords, as the other does not, a scientific basis for the investigation of the laws of anthropology. The action of an organism in seeking the satisfaction of a desire finds an exact parallel in the action of a chemical molecule in seeking combination with others, or that of a column of air in rushing in to fill a vacuum. The desires of individuals constitute true forces, identical in all respects with the physical forces which other sciences deal with, and all branches of anthropology, including that of sociology, at once take their places as true sciences. This antithesis may perhaps be rendered more striking by considering function as the object which nature seeks, and feeling as that which man seeks. The object or end of nature is the preservation and perpetuation of existing life; that of man, and of all beings endowed with feeling, is the satisfaction of existing desires. The former is objective and constitutes a biological process; the latter is subjective, and is a moral or sociological process.

Properly understood these precesses possess no natural or necessary relation to each other. It is easy to imagine a person wholly destitute of taste. Indeed such cases are on record. The pleasure derived from the contact of nutritious substances with the tongue and palate is obviously distinct from the benefit which it confers upon the system after digestion. Such a person as we have supposed would none the less need food because he had no desire to partake of it.

It is still more easy to conceive of a total absence of the sexual instinct, and this is a much more common pathological condition found in practice. Here the feeling is still more obviously distinct from the function.

Why then do these desires and their functional results so universally accompany each other? The answer is that this apparently "pre-established harmony" of things having no necessary relation or resemblance has been the result of natural adaptation.

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as of all other pleasures, and all pain also, is explained on the theory of selection.

It is desire alone which leads to action. Among the lower animals it is the momentary impulse which always determines action. Hence these, if destitute of these passions in the gratification of which they preserve their existence and continue their kind, would speedily perish.

In man both these desires are strong and constitute the motive, either direct, or indirect, to the greater part of his acts.

There are of course other desires, many of which may be regarded as derived from these, but some of which are apparently also original and natural, but whatever they may be they are in the nature of forces, and all the desires taken together may be appropriately called the *Social Forces*. These social forces readily fall into two groups and each of these is capable of subdivision into subordinate groups, as the following table will show :

Essential Forces.	Preservative Forces.	Positive, gustatory (pleasurable)
		Negative, protective (painful.)
Non-essential Forces.	Reproductive Forces.	Direct (The sexual instinct.
		Indirect Parental and consanguineal affections.
	Esthetic.	
	Emotional.	
	Intellectual.	

Space forbids the elaboration of this table, and indeed it scarcely requires it. I will only say a word on the last group named in it, the intellectual forces. Upon this point much confusion, and as I think, error prevails. It is at the present time at least, a very small and unimportant group. Properly it embraces nothing beyond the mere yearnings of the intellect. Its only basis is the pleasure of intellectual action.

I strenuously object to throwing the whole effect of mind in social development into the class of social forces. The social forces are indeed psychic, but they are not intellectual. The intellect is in no true scientific sense a force. It is not a motor influence.

It is characteristic of every true natural force that the body impelled or attracted by it moves in a straight line from the impelling or towards the attracting object. If it move in a curve or any but a straight line this is always due to a plurality of forces acting in different directions. This is true of all the social forces. Desire, wholly unaccompanied by reason, always impels in a direct line towards its object. This is illustrated most clearly by the acts of the lower animals.

The fly buzzing against the transparent pane until exhausted without sufficient intelligence to try another locality is an example daily witnessed. Moths seeking a flame regardless of its destructive power, and rising with scorched wings, plunging anew into the fatal charm, show the action of a force scarcely higher than the purely mechanical. It is so with every form of desire. But for the intellectual agency, to however slight a degree, all animal action, human action included, would be of this direct character. The influence of mind sustains the same relation to the true forces of desire that the rudder of a ship, moved by the helmsmen, sustains to the sails acted upon by the wind. As it is not the former that propels the ship so it is not mind that propels society. The great results which are collectively termed civilization are the direct outcome of these impulsive social forces, guided, of course, by intellect or reason. All the efforts that have been put forth have been made solely for the satisfaction of present desires. The end really reached has not been the end sought. Function has been totally ignored and feeling alone consulted. The ends of Nature have been attained, not directly as objects of pursuit, but only indirectly through the means of Nature which are the ends of the feeling creature.

It has been remarked that owing to adaptive influences these naturally independent lines leading respectively to the ends of Nature and the ends of the sentient organism converge to the same point. The effects produced by obeying the desires in most cases are the effects necessary to preserve, perpetuate, and develop the organism. But here is the fundamental distinction to be noted. These functional effects are secondary. It is not to secure them that the acts are performed. The beings performing them

take no thought of them. The only effect in the mind of the agent is the satisfaction of a present desire. It may be safely said that this is almost universally the case even in human action.

But it may be asked what difference it makes, inasmuch as the indirect or functional end is always secured by the previous harmony brought about by adaptation.

With non-progressive beings like the lower animals, it may be admitted that it makes but little difference. Here the chief interest centres on biological questions, questions of anatomy, histology, morphology, etc., and therefore the objective or biological standpoint is usually, though not always, sufficient. But with man, a progressive being, whose actions transform the entire face of the planet and lift him by rapid steps from one plane of activity and life to another, it becomes of the utmost importance that the true nature of his motives be scientifically understood ; that the effects produced be attributed to their true immediate causes and not to indirect or merely incidental ones. Nutrition is not an end of human conduct in seeking food ; it is the satisfaction of hunger. A family is rarely a direct desideratum in human life. Every physician knows how often it is an object of dread. It is only an incident. The great blessings of accumulated wealth have never been the immediate object of industry and financing skill. These are the direct results of that great derivative passion called avarice which has been so unjustly condemned. Industry, commerce, art, and often invention flow from the "love of money," which has been most superficially called "the root of all evil," when it is really the root of nearly all good in civilization. Labor is performed and heroic deeds achieved not to make the world richer and happier or set examples of nobility for future ages, but to secure the immediate wants of the individuals performing them, to gain money and applause, to win the fair and to support them. Avarice, ambition, love, each has accomplished its direct results in the true civilization of the race.

PROFESSOR EDWARD D. COPE

The bibliography of Professor Edward D. Cope has been ably written by Professor William Hosea Ballou, one of our subscribers :—Professor Ballou states that, "the life of Prof Cope is the index of all that is romantic in science. A sketch of his literature would be void of much of the interest attached without notation of some of the points in his most extraordinary career. At the early age of sixteen he began writing on scientific matters, though he must have attained twenty-four years when his writings first began to attract attention. He is one of the few living writers who has been able to successfully turn at will from any department of living biological forms to those whose remains are found only in fossil state. From studies of this nature he boldly enters the realms of metaphysics, bringing out an astounding number of genuine contributions to knowledge. In the bodies of learned men of which he is a leading figure, he astonishes all who hear him by the facility with which he addresses or converses on topics under discussion. He seems both in his writings and speeches a man prolific in voluminous knowledge of kindred subjects. His investigations have already resulted in his naming upwards of 1,000 species new to science, besides innumerable genera. He has written on every existing family of vertebrates, and revolutionized the classification of the amphibious animals by utilizing the skull as a source of differential characters. The classification of fishes has also been much modified by him.

The best part of his work is undoubtedly comprised in his paleontological (extinct animal) studies which have distinguished him throughout the scientific world. In 1879 the Royal Geological Society of Great Britain awarded him a medal for doing the most work in this line of any individual for the year."

This interesting memoir can be found in the *Chicago Field*, for August 21 and 28, and with the list of Professor Cope's literary papers and contributions, occupies eleven columns of that journal.

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		Esthetic.
		Emotional.
		Intellectual.

Space forbids the elaboration of this table, and indeed it scarcely requires it. I will only say a word on the last group named in it, the intellectual forces. Upon this point much confusion, and as I think, error prevails. It is at the present time at least, a very small and unimportant group. Properly it embraces nothing beyond the mere yearnings of the intellect. Its only basis is the pleasure of intellectual action.

I strenuously object to throwing the whole effect of mind in social development into the class of social forces. The social forces are indeed psychic, but they are not intellectual. The intellect is in no true scientific sense a force. It is not a motor influence.

It is characteristic of every true natural force that the body impelled or attracted by it moves in a straight line from the impelling or towards the attracting object. If it move in a curve or any but a straight line this is always due to a plurality of forces acting in different directions. This is true of all the social forces. Desire, wholly unaccompanied by reason, always impels in a direct line towards its object. This is illustrated most clearly by the acts of the lower animals.

The fly buzzing against the transparent pane until exhausted without sufficient intelligence to try another locality is an example daily witnessed. Moths seeking a flame regardless of its destructive power, and rising with scorched wings, plunging anew into the fatal charm, show the action of a force scarcely higher than the purely mechanical. It is so with every form of desire. But for the intellectual agency, to however slight a degree, all animal action, human action included, would be of this direct character. The influence of mind sustains the same relation to the true forces of desire that the rudder of a ship, moved by the helmsmen, sustains to the sails acted upon by the wind. As it is not the former that propels the ship so it is not mind that propels society. The great results which are collectively termed civilization are the direct outcome of these impulsive social forces, guided, of course, by intellect or reason. All the efforts that have been put forth have been made solely for the satisfaction of present desires. The end really reached has not been the end sought. Function has been totally ignored and feeling alone consulted. The ends of Nature have been attained, not directly as objects of pursuit, but only indirectly through the means of Nature which are the ends of the feeling creature.

It has been remarked that owing to adaptive influences these naturally independent lines leading respectively to the ends of Nature and the ends of the sentient organism converge to the same point. The effects produced by obeying the desires in most cases are the effects necessary to preserve, perpetuate, and develop the organism. But here is the fundamental distinction to be noted. These functional effects are secondary. It is not to secure them that the acts are performed. The beings performing them

take no thought of them. The only effect in the mind of the agent is the satisfaction of a present desire. It may be safely said that this is almost universally the case even in human action.

But it may be asked what difference it makes, inasmuch as the indirect or functional end is always secured by the previous harmony brought about by adaptation.

With non-progressive beings like the lower animals, it may be admitted that it makes but little difference. Here the chief interest centres on biological questions, questions of anatomy, histology, morphology, etc., and therefore the objective or biological standpoint is usually, though not always, sufficient. But with man, a progressive being, whose actions transform the entire face of the planet and lift him by rapid steps from one plane of activity and life to another, it becomes of the utmost importance that the true nature of his motives be scientifically understood; that the effects produced be attributed to their true immediate causes and not to indirect or merely incidental ones. Nutrition is not an end of human conduct in seeking food; it is the satisfaction of hunger. A family is rarely a direct desideratum in human life. Every physician knows how often it is an object of dread. It is only an incident. The great blessings of accumulated wealth have never been the immediate object of industry and financing skill. These are the direct results of that great derivative passion called avarice which has been so unjustly condemned. Industry, commerce, art, and often invention flow from the "love of money," which has been most superficially called "the root of all evil," when it is really the root of nearly all good in civilization. Labor is performed and heroic deeds achieved not to make the world richer and happier or set examples of nobility for future ages, but to secure the immediate wants of the individuals performing them, to gain money and applause, to win the fair and to support them. Avarice, ambition, love, each has accomplished its direct results in the true civilization of the race.

PROFESSOR EDWARD D. COPE

The bibliography of Professor Edward D. Cope has been ably written by Professor William Hosea Ballou, one of our subscribers :—Professor Ballou states that, "the life of Prof Cope is the index of all that is romantic in science. A sketch of his literature would be void of much of the interest attached without notation of some of the points in his most extraordinary career. At the early age of sixteen he began writing on scientific matters, though he must have attained twenty-four years when his writings first began to attract attention. He is one of the few living writers who has been able to successfully turn at will from any department of living biological forms to those whose remains are found only in fossil state. From studies of this nature he boldly enters the realms of metaphysics, bringing out an astounding number of genuine contributions to knowledge. In the bodies of learned men of which he is a leading figure, he astonishes all who hear him by the facility with which he addresses or converses on topics under discussion. He seems both in his writings and speeches a man prolific in voluminous knowledge of kindred subjects. His investigations have already resulted in his naming upwards of 1,000 species new to science, besides innumerable genera. He has written on every existing family of vertebrates, and revolutionized the classification of the amphibious animals by utilizing the skull as a source of differential characters. The classification of fishes has also been much modified by him.

The best part of his work is undoubtedly comprised in his paleontological (extinct animal) studies which have distinguished him throughout the scientific world. In 1879 the Royal Geological Society of Great Britain awarded him a medal for doing the most work in this line of any individual for the year."

This interesting memoir can be found in the *Chicago Field*, for August 21 and 28, and with the list of Professor Cope's literary papers and contributions, occupies eleven columns of that journal.

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This paper was a general review of observations on the water of Fresh Pond, as delivered in the City of Cambridge. These observations extend, at intervals varying from a few days to a month, over three years. Particular attention was called to the fact that there seems to be a marked periodicity in the forms of life in the water, some appearing at certain seasons and then disappearing again. This periodicity is not always annual, but may embrace a period of time covering several years. Attention was called to the necessity of continued observation of a water in order to understand its character. The periodical bad taste of certain waters was referred to, and the suggestion made, that in order to discover the cause of this, extended observations were necessary, as frequently the cause had entirely disappeared when the investigation commenced. A new species of *Annurea* observed in the pond, was described as follows: *Annurea Longirostris*, lorica, with four anterior and one posterior spine; three of the anterior spines short about half the length of the lorica; the fourth twice the length of the lorica; the posterior of the same length as the long anterior, otherwise resembling *Annurea Stipata*, though more slender.

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THE METRIC SYSTEM AND INTERCHANGE OF WEIGHTS AND MEASURES. By B. Beach, Jr., and E. N. Gibbons, Principals of the Fifth Avenue School of New York City. G. P. Putnam's Sons. New York. 1880.

The metric system has been adopted by all civilized nations except Russia, England and the United States, and its universal adoption is earnestly desired by the educated and scientific classes of this country. It has been adopted or recommended by the National Academy of Sciences, the American Metrological Society, the American Association for the Advancement of Science, by the American Society of Civil Engineers, the United States Coast Survey, the United States Marine Hospital Service, the American Medical Association, the Congress of Ophthalmologists, by leading medical societies and journals, by numerous boards of education, college faculties and local scientific societies. It is also our wish that contributors to this journal should, on all occasions, use the metric system, and we have pleasure in directing atten-

* Read before the A. A. S., Boston, 1880.

tion to the present cheap and handy little manual, written for those desirous of making use of the metric system. As a class-book in schools it will prove very valuable, as rules and examples are given for working out problems for all weights and measures, answers to which are given, on an extra sheet, with each book. We advise all who are undecided as to the policy of using the metric system to read Dr. R. H. Ward's able plea for its introduction in No. 5 of "SCIENCE," published the 31st of July last. He concludes with the practical observation that the proper way to introduce it is to use it yourself. We believe the publication of Messrs. Beach and Gibbons's manual will be a great aid in securing its universal use.

FOURTEEN WEEKS IN PHYSICS. By J. Dorman Steele, Ph. D., F. G. S., author of "Fourteen Weeks in Natural Science." A. S. Barnes & Company. New York, Chicago and New Orleans.

This is an excellent elementary work on Physics adapted to the class-room, written in a happy style to interest the student and well supplied with illustrations. The author employs simple language, which is readily intelligible, and the experiments are within the reach of every pupil. In order to familiarize the pupil with the metric system it is constantly employed in the problems. As an introduction to the study of physics we consider this work one of the best for the use of young students.

THE YOUNG CHEMIST.—A book of Laboratory work for beginners. By John H. Appleton, A. M., Professor of Chemistry in Brown University. Second Edition. Price 90 cents by mail. Cowperthwaite & Co., Philadelphia.

The purpose of this book is to aid in the instruction of pupils in chemistry by the experimental or object method, and the author has attempted to remove at least one objection to this method by economizing the time of the instructor, and we are glad to admit that the cost of supplies has been greatly reduced of late. Professor John H. Appleton claims with truth the following advantages for his work:—*First*, the apparatus described and the supplies called for, are of the simplest character. *Second*, the experiments are described in clear and simple language, and in direct form; the pupil can hardly fail to perform them successfully, even without the special aid of the teacher. *Third*, dangerous experiments have been excluded. *Fourth*, the chemical elements are discussed in a scientific order, which, while it aids the memory, does so upon correct principles. *Fifth*, formulas and reactions are introduced freely, so that the student learns the new nomenclature and new notation without suspecting it. This work is not an experiment, the first edition having been used with success by Professors of great experience.

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The author has used this work in his own class for many years, and to those who are unable to purchase the more bulky and costly manuals this little work will be found of great use. It has the advantage of brevity and compactness. It prescribes the most direct and simple course of analysis, and presents a large number of formulas and reactions. This work and the "Young Chemist," by the same author, will be found very suitable for those who require a reliable introduction to the study of chemistry.

TWO NEW METHODS OF FIGHTING INJURIOUS INSECTS.*

BY PROF. A. J. COOK.

The Codling Moth has been, and is, the most serious pest to the American pomologist. All previous remedies have only destroyed the Imago insect, after the larva of the same had destroyed the apples. London Purple, applied as a liquid mixture, one pound of the poison to 100 gallons of water, sprinkled on the trees once in May and again in June, has saved the fruit of the following season. Upon picking the fruit in August, the most delicate chemical test could find none of the poison on the apples.

Bisulphide of carbon, so excellent in fighting museum pests, and so much esteemed as a specific against the grape phyloxera in Europe has been tried by the author of the paper to destroy the Cabbage Maggots, *Anthomyia brassicae*, and other insects which infest subterranean stems, etc., with excellent success.

A hole is made in the ground, the liquid poured in and the hole quickly filled with earth, which is pressed down with the foot. The hole is made with a small rod, close to the plant, and about a table spoon-full of the liquid poured into each hole.

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